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Abstract

The potential benefits of groupware, multi-user computer technology to support communication or collaboration, have been shown in laboratory settings and case studies. However, some types of groupware are not being adopted as quickly as expected. A metaphorical model of groupware diffusion/adoption is proposed based on ecological analogies to island biogeography and ecological succession. The groupware is viewed as new species entering the organizational ecology. This paper outlines methodology and approach to study the use, development, and diffusion of this groupware technology in the context of a medium-sized technical consulting organization with a decentralized Information technology (IT) management. This model is also tied to other models of IT diffusion/adoption including Davis's IT acceptance model and adaptive structuration.

Introduction

Technology diffusion has been an active field of study covering many diverse technology forms since the 1930s [Rogers 1995]. Recently, information technology (IT) has been a major subject of diffusion studies because of IT's rapid advance and impact on the economy [Drucker 1995]. However, IT that requires adoption at an organizational level, such as object-oriented technologies [Bhattacherjee and Gerlach 1998] and groupware [Briggs et al. 1999], are not being adopted and diffused as quickly as predicted, despite research showing their benefits.

To understand the relatively slow adoption and diffusionof groupware, contextual investigations of the appropriate scope must be performed [Lee et al.1998, Levine and Monarch 1998, Orlikowski 1996, Ciborra 1996]. Diffusion studies' dimensions include the time period, technology characteristics, and the organization's size and social environment.

While some aggregate diffusion models have a worldwide scope of thousands of years [Marchetti 1994], others concentrate on the U.S. after World War II [Andolfatto and McDonald 1998]. These large-scale models expose general trends and can lead to interesting hypotheses, although causal models are difficult to construct. To investigate causal models, the scope must be reduced in size and time. To that end, this study investigates the use of groupware by a medium-size organization (about 100 professionals) over a period of two years, along with historical evaluation of groupware use in the organization for over five years.

The relevant technology characteristics [Rogers 1995] are the relationships within the technology set and the interaction of the organization with the technology. To be adopted some technologies require a single decision by an individual about one specific technology. An example is the classic study of hybrid corn diffusion, in which each farmer could try different strategies independent of other farmers' decisions and decisions about other technologies [Rogers 1995]. Groupware, however, is comprised of a set of inter-dependent technologies that require a set of decisions to be made by a group rather than a single individual.

This last aspect emphasizes the importance of the organizational social settings, norms, and dynamics in the diffusion of groupware technologies. In many large organizations, the Information Technology Division has high visibility, with positions such as "Chief Information Officer." However, in many "knowledge-based" firms, the smaller, consulting-like setting leads to distributed management of IT activities. Drucker [1995] claims these types of organizations will continue to flourish under the new paradigm of an information age economy. The relevant contradiction is that the new organizational style needs groupware on the basis of its information use, project independence, and distributed expertise, yet the same factors contribute to distributed IT management that does not have a direct mechanism to facilitate groupware diffusion.

One groupware technology taxonomy includes four components: communication channels, analysis tools, process structure tools, and shared structured information storage [Coleman 1997]. These components have various features and levels of complexity. One feature is the ability to support various communication media. For example, textual e-mail might be considered the basic form of asynchronous messaging, although this is extended to other media (voice, video, VRML clips) and extended by incorporating aspects from storage to sustain organized discussions such as newsgroups and forums.

My hypothesis is that the diffusion of a set of technologies such as groupware in a loosely coupled (distributed management) organization is analogous to an ecological system experiencing transformation as a result of the sudden contact with another ecosystem due to geography changes (island bio-geography) or climate

changes (succession). However, a difference between the groupware technology and the invading species is the interacting time-scales. In the invading species model the ecosystem change is much quicker than the evolutionary change. However, for the groupware technology adoption model, the technology is changing at a rate comparable or quicker than the organization change.

In ecological succession, after a change in conditions, the ecology of a certain region experiences a succession of species that modify the land to facilitate the next ecosystem level [Krebs 1978]. In the classic case of dune succession, the first species are grasses, followed in turn by shrubs, cottonwood, pines, and finally oak forests. An analogy to groupware could be made with the grasses being the textual e-mail, network drives, and chat.

In natural ecosystems, the mature form is not supported at the earliest stages. Both the land and species distribution must change to develop the correct conditions for maturation. This is similar to the adaptive structuration model of IT diffusion, in which the technology and the organization form a feedback loop each influencing the other [Poole 1990]. On the basis of the analogy of the organization as the original ecosystem, the slow acceptance of a full groupware package can be understood to be similar to the succession of ecosystems leading to the mature ecosystem. In this model, the systems explore relationships leading to succession of technologies and species.

Supporting evidence is found in the study of groupware system adoption at the US Navy Third Fleet [Briggs et al. 1999]. Groupware experts serving as action researchers and facilitators aboard ship for over two years. During this period the researchers, who might be viewed in this analogy as farmers artificially supporting an ecosystem, planted several seeds of groupware use. Many of the seeds grew into plants while these farmers tended them, but most died out when the farmer researchers moved on. However, a few isolated plants flourished; a team logbook used by Navy Intelligence took on a life of its own even without the active intervention of the researchers. This fully diffused success might be explained by an environmental readiness to accept the technology. The dimensions of such an environmental readiness are questions for this current research.

Several hypotheses emerge from the use of this metaphor:

- Groupware diffuses best if introduced with simple reconfigurable objects [Briggs et al. 1997], allowing the organization to adapt, explore the secondary effects of the technology, and find niches for the technology that fits the current corporate culture.
- Early growth in a sub-section of the organization might not be sustainable but can contribute to the diffusion.
- The number of groupware types might be limited by the size of the interacting organization similar to the correlation found in island bio-geography that the number of species increase by 2 for every order of magnitude increase in land area.
- The diffusion of groupware in an organization may need to follow a pattern beginning with simpler forms of groupware which are gradually supplanted by more complex or comprehensive forms of groupware.

To study this type of diffusion in an organization, the many components and uses of groupware require investigation within the complex distributed management context. To better understand the processes which work and fail, an action research methodology [Avison et al. 1999] is proposed. The model and hypothesis above suggest a positivist qualitative methodology. The model will be continually tested through action and reflection based on the data collected through organizational actions, interviews, questionnaires, and primary documents.

The model will be continually refined through system modeling based on ecological models. Components of the model will be derived from general diffusion theory, adaptive structuration theory, IT assessment models, communication network models, and critical mass theory.

The research actions will include

- development, for external products and internal processes
- scanning and evaluation of new tools and techniques
- participation on development and marketing committees
- facilitation of marketing proposals,
- informal presentation, training, and consulting, and
- exploration of project organization through groupware.

The documents should provide information about the groupware types and usage patterns at the various stages of diffusion/adoption: scanning, exposure, trial, persuasion, development, and ingrained organizational use. Particular attention to tradeoffs of investment in

learning versus paybacks in development is necessary. Organizational issues such as incentives and communication patterns will be observed and measured with the ability to discern their implicit and explicit nature. The surveys will cover standard organizational issues and developing knowledge management concerns. The data collection phase will cover 2 years from the initiation of an IT strategic plan. This time period covers over one generation of computer technology (Moore's Law) and will include 3 annual strategic plans.

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